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Short Communications (Research Advances)

Discovery of ~2.5 Ga zircon U-Pb age from the diabase, Ar Horqin Banner Area, Inner Mongolia: Implications for Neoproterozoic crystalline basement of Bainaimiao Arc Belt

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1. Objective

The Bainaimiao Arc Belt (BAB), one of the most important units of the southeastern Central Asian Orogenic Belt (CAOB), locates along the northern margin of the North China Craton (NCC). There is a lack of understanding on the existence, scale, and affinity of the crystalline basement of the BAB. Based on the recent geochronologic studies, most of the so-called Proterozoic metamorphic rocks (for example, Bainaimiao Group) are Early Paleozoic in age. Lacking reliable Precambrian data, the basement of the BAB does not extend largely only according to the Neoproterozoic mass recognized recently in the Jiefangyingzi Area, while some scholars even argue that this Neoproterozoic mass belongs to the NCC or relates to the tectonic nappe. Does the Precambrian basement of the BAB exist? This paper reports a new discovery of Neoproterozoic zircon ages from the diabase in the Ar Horqin Banner Area of the northern edge of the BAB.

2. Methods

The sample was collected from the NEE-trending diabase dyke (43°36'45"N, 119°38'33"E; Fig. 1), which intruded the Permian sediments and was partly covered by Quaternary, in the Ar Horqin Banner Area, Inner Mongolia, China. Rock crushing, zircon separation, and cathodoluminescence (CL) images were performed at Yu-Heng Rock & Mineral Technology Service Limited Company, Langfang, China. Zircon U-Pb dating was carried out by LA-ICP-MS at the

State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Science.

3. Results

The dating results of zircon U-Pb isotope analysis are shown in Supplementary Table 1. Zircons from the diabase are mainly subhedral, 70–150 μm long, and present length/width ratios of 1 : 1 to 3 : 1. A magmatic origin is indicated by fine-scale oscillatory growth zoning and high Th/U ratios of 0.3–1.0. Narrow grey rims around some of the grains in the CL images are interpreted as subsequent metamorphic overgrowths (Fig. 2a). A total of 22 zircons were analyzed, and 16 data of captured zircons are well aligned on the Concordia diagram and define a discordia line with upper intercept age of 2559±20 Ma (MSWD=0.42), while these 16 data range from 2448±31 Ma to 2600±39 Ma, yielding a weighted mean ²⁰⁷Pb/²⁰⁶Pb ages of 2526±19 Ma (MSWD=1.5) (Fig. 2c). As this characteristic of a high proportion of ~2.5 Ga zircons is significantly different from the composition of detrital zircons from Phanerozoic sediments, these old zircon ages clearly suggest the presence of Neoproterozoic geological body beneath, which shows a similar affinity to the NCC basement. Besides, one datum with ²⁰⁷Pb/²⁰⁶Pb age of 1739±33 Ma represents the Paleoproterozoic captured age, which is consistent with the initial rifting event and anorogenic magmatism of the NCC. Another five zircons yield concordant ²⁰⁶Pb/²³⁸U ages varying from 153±3 Ma to 440±4 Ma, and they are interpreted to be related to various magmatic events in Phanerozoic.

4. Conclusion

High proportional captured zircons from the intrusion of diabase in the Ar Horqin Banner area have a weighted mean ²⁰⁷Pb/²⁰⁶Pb age of 2526±19 Ma (MSWD=1.5) and an upper

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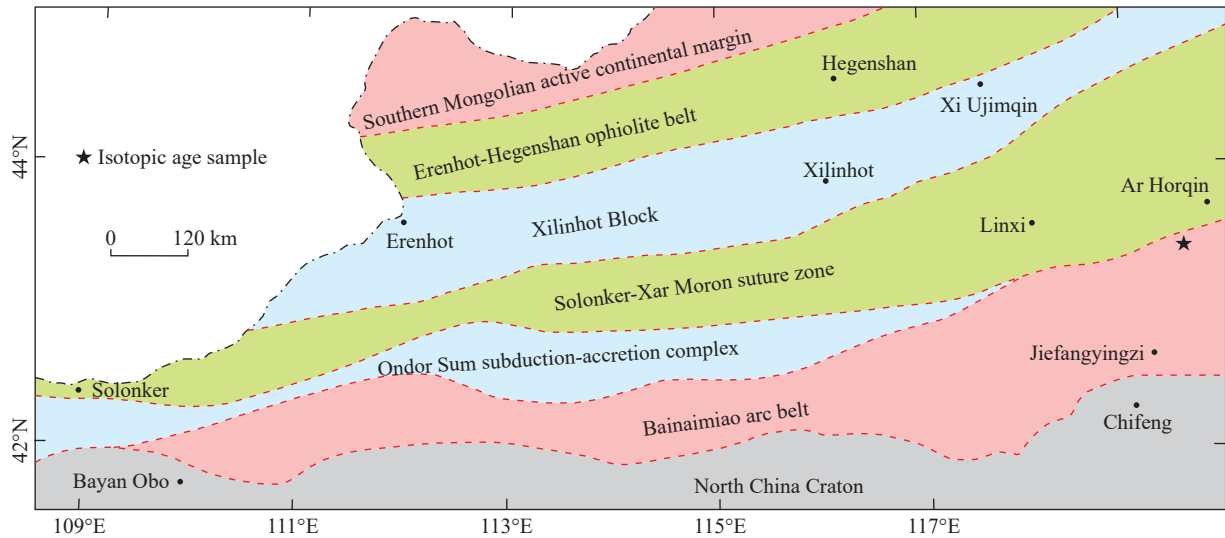


Fig. 1. Tectonic sketch map of the southeastern Central Asian Orogenic Belt (CAOB).

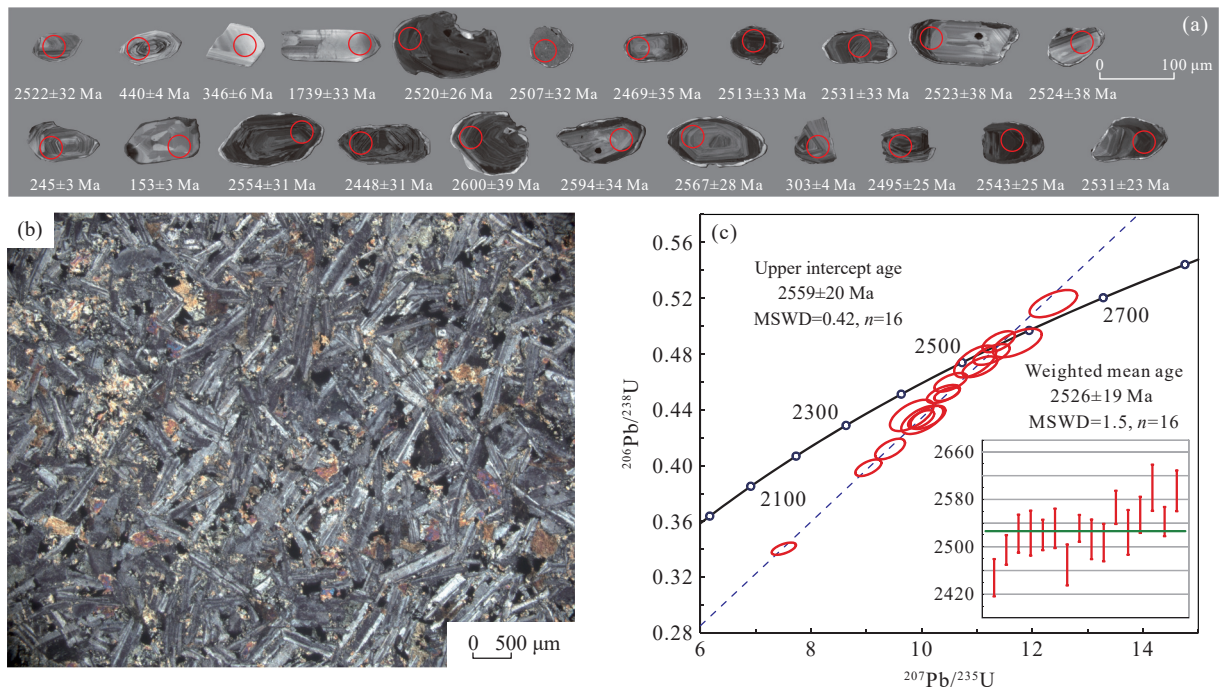


Fig. 2. CL images (a) of zircons, photomicrograph (b), and zircon U-Pb concordia diagrams and relative probability plots (c) for the Diabase in Ar Horqin Banner area, Inner Mongolia, China.

intercept age of 2559 ± 20 Ma (MSWD=0.42), which clearly suggests the presence of Neoproterozoic geological body on the northern edge of the BAB, reflecting the existence of the Neoproterozoic crystalline basement.

CRediT authorship contribution statement

Ji-yu Du, Cheng Qian, Wen-bin Wu, and Chao Zhang conceived of the presented idea. Ji-yu Du and Yu-jin Zhang carried out the experiment. Ji-yu Du wrote the manuscript with support from Yu-jin Zhang, Yong-fei Ma, and Tao Qin. Yong-fei Ma and Hong-xi You encouraged Ji-yu Du to investigate. All authors discussed the results and contributed to the final manuscript.

Declaration of competing interest

The authors declare no conflicts of interest.

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Supplementary dataset

Supplementary Table 1 of this article can be found online at doi: [10.31035/cg2022048](https://doi.org/10.31035/cg2022048).